REMARKS

Claims 14-44 are pending in the application. Claims 14-44 stand rejected. Claims 14-44 were rejected under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement.

Applicants thank Examiner Singh for the telephone conversation on Friday, November 14, 2007 regarding the response to Office Action filed on August 23, 2007 in the above-identified application. During the conversation, a clerical error regarding U.S. Patent Number 5,343,522 by Yatrou *et al.* was clarified.

Objections to Drawings

On Page 2 of the present Office Action, the drawings are objected to under 37 CFR 1.83(a), as failing to show every feature of the invention specified in the claims. Specifically, the Office Action states that the elements "first predetermined condition" and "second predetermined condition" recited in Claims 14, 17-21, and 24-27 are not shown in the drawings of the apparatus. The Office Action also states that since claims 14-27 are method claims, these features must be shown in a flowchart.

Regarding the element "**first predetermined condition**," Applicants refer to Fig. 6, where the adaptation procedure recited in Claim 14 converges in the mean-square sense to the correct solution if $0 < a_n < 2$. Gain constant a_n is used for regulating convergence. Applicants' Fig. 6, as described on pages 19 through 26 of the original Application, presents several scenarios (i.e., **first predetermined conditions**) for changing this gain constant. For example, the first predetermined condition may be, as recited in Claim 17, an existence of a non-linear echo response path. In this case, the echo canceller proceeds according to procedures shown on lines 230 and 235 of the flow chart presented in Fig. 6 by setting the value of $a = 0.25$.

Regarding the element "**second predetermined condition**," Applicants refer to Fig. 7, where a subset of coefficients of the $\hat{h}$ filter are adapted with a higher gain and the remaining coefficients are adapted with a smaller gain. An example of such scenario, as recited in Claim 20, is when the echo canceller converges to a linear echo path (i.e., **second predetermined condition**). In this case, as illustrated in Fig. 7, the echo canceller divides the taps into window sections and proceeds to determine which of the windows has the largest amount of energy

disposed therein. The windows having the largest amount of energy are tagged as being more significant than other windows.

Thus, Applicants respectfully submit that the elements of "adapting high-energy filter tap coefficients and low-energy filter tap coefficients using adjustable gain constants, based on an occurrence of a first predetermined condition and separately adapting the high-energy filter tap coefficients from the low-energy filter tap coefficients based on an occurrence of a second predetermined condition," as recited in Claims 14, 17-21, and 24-27, is supported by Figs. 6 and 7. Accordingly, Applicants respectfully request that the objection under 37 CFR 1.83(a) be withdrawn.

Objections to Specification

On Page 3 of the present Office Action, the specification is objected to as failing to provide the status of co-pending applications cited on pages 1, 17, 21, and 25 of the Application. Applicants refer to the Preliminary Amendment filed on February 17, 2004, in which the specification was amended to include references to the co-pending application. Accordingly, Applicants respectfully request that the objection to the specification be withdrawn.

Rejections Under 35 U.S.C. §112, First Paragraph

Claims 14-44 were rejected under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement. Specifically, the Office Action states that the disclosure does not support the elements "first predetermined condition" and "second predetermined condition," as recited in Claims 14 and 21. The Office Action also states that the specification does not support the elements "first energy level" and "second energy level," recited in Claim 28. The Office Action further states that the element of "adjusting speed of convergence," as recited in claim 36, is not supported by the specification.

Regarding the element "**first predetermined condition**," Applicants refer to Fig. 6, as well as the description presented on pages 19 through 26 of the Application, presenting several scenarios (i.e., **first predetermined conditions**), such as existence double talk, existence of non-linear echo response path (Claim 17), existence of data call (Claim 18), and existence of a narrow bandwidth signal (Claim 19), for changing the gain constant used for regulating

convergence. As an example, Applicants refer to the discussion presented in the second full paragraph of Page 23, wherein the first predetermined condition is an existence of a narrow bandwidth signal (Claim 19):

> A further condition in which the adaptive gain may be altered from an otherwise usual gain value occurs when the adaptive filter is confronted with a far-end signal that is narrow band, i.e. comprised of a few sinusoids. In such a scenario, there are an infinite number of equally optimal solutions that the LMS adaptation scheme can find. Thus it is quite unlikely that the resulting cancellation solution $\hat{h}$ will properly identify (i.e. mirror) the channel echo response h. Such a situation is referred to as under-exciting the channel, in that the signal only provides information about the channel response at a few frequencies. The echo canceller 25 attempts to determine the existence of this condition at step 220.

Regarding the element "**second predetermined condition**," Applicants refer to the discussion presented in the second full paragraph of page 27 of the Application. As discussed in this paragraph, the inventors have recognized that there may be cases (i.e., **second predetermined conditions**) where it is useful to adapt a subset of coefficients with a higher gain and the remaining coefficients are adapted with a smaller gain. An example of such predetermined condition includes the scenario in which the echo canceller converges to a linear echo-path (Claim 20):

> Separate and apart from the foregoing adjustments of the gain constant a, the present inventors have recognized that it may be advantageous to adapt a subset of the coefficients of the $\hat{h}$ filter with a higher gain and the remaining coefficients with a smaller gain. To understand the motivations for doing this, consider a scenario in which the echo canceller 25 must converge to a linear echo-path. Since some flat-delay is to be expected, the span of time covered by the coefficients of the $\hat{h}$ filter should be larger than the expected duration of the echo-path response. As a result, several of the taps (and in many cases, the majority of the taps) of the $\hat{h}$ filter will have an expected value of zero to model the flat-delay while a small subset of "significant" taps will need to adjust very quickly in order to model the linear echo-path response.

Regarding the elements "**first energy level**" and "**second energy level**," recited in Claim 28, Applicants refer to the discussion presented in the first full paragraph of page 28:

> FIG. 7 illustrates an $\hat{h}$ filter tap energy distribution for a typical linear echo path. The echo canceller 25 divides the taps into window sections, each window section preferably having the same number of taps. The echo canceller 25 then proceeds to determine which of the windows has the largest amount of energy disposed therein. The windows having the largest amount of energy are tagged as being more significant than other windows. The adaptive coefficients of the relatively few tagged windows are adapted separate from adaptive coefficients of the larger number of low energy, non-tagged windows. This naturally results in faster convergence of the coefficients of the tagged windows compared to convergence of the coefficients of the tagged windows in a non-split scenario. Still further, the adaptive coefficients of the tagged windows may be adapted using a higher gain constant α than the gain constant α' used to adapt the lower energy windows.

The paragraph presented above discusses a procedure of dividing taps into windows having the largest amount of energy and windows having lower energy levels (i.e., taps associated with a **first energy level** and second group of filter taps associated with a **second energy level**).

Regarding the elements "**adjusting speed of convergence**," recited in Claim 36, Applicants refer to the discussion presented on lines 6-8 of the first full paragraph of page 28:

> The adaptive coefficients of the relatively few tagged windows are adapted separate from adaptive coefficients of the larger number of low energy, non-tagged windows. This naturally results in faster convergence of the coefficients of the tagged windows compared to convergence of the coefficients of the tagged windows in a non-split scenario.

The paragraph presented above discusses the element of **adjusting speed of convergence** of high-energy and low-energy filter tap coefficients.

Thus, Applicants respectfully submit that the elements of "a first predetermined condition," "a second predetermined condition," "a first energy level," "a second energy level," and "adjusting speed of convergence," as recited in Claims 14, 21, 28, and 36, are supported by the specification. Accordingly, Applicants respectfully request that the objection under 35 U.S.C. §112, First Paragraph be withdrawn.

Because Claims 15-20, 22-27, and 29-44 depend from Claims 14, 21, and 28, Applicants respectfully submit that these claims should be allowed for a least the same reasons as their

corresponding base claims and request that the objection under 35 U.S.C. §112, First Paragraph be withdrawn.

CONCLUSION

In view of the above amendments and remarks, it is believed that all pending claims, Claims 14-44, are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By /Mark B. Solomon, Reg. No. 44348/
Mark B. Solomon
Registration No. 44,348
Telephone: (978) 341-0036
Facsimile: (978) 341-0136

Concord, MA 01742-9133
Date: 2/26/08